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By-Greenawalt, George J.; Mitchell, Donald P.

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The accuracy of the percentage of survival technique (P-S Method) for predicting school enrollment is examined by testing it on 242 towns and cities in Massachusetts. An attempt is also made to identify certain factors associated with accuracies and inaccuracies in the P-S Method. Three general conclusions are drawn: (1) The P-S Method produces the greatest error in fast-growing communities that most need accurate enrollment forecasts, (2) enrollment change is a fairly good predictor of forecast accuracy, and (3) in larger school systems a forecast that is technically "accurate" (within 10 percent error) may be inaccurate by several hundred or even several thousand students. Four general classifications of factors affecting population and thus enrollment are (1) The number of dwellings available in the community, (2) the type of people living in those dwellings, (3) the demand for dwellings in the community, and (4) factors controlled by public and nonpublic schools. A number of sources of information can be tapped by the school administrator to allow him to make better enrollment forecasts. (HW)

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PREDICTING SCHOOL ENROLLMENTS

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Predicting School Enrollments

by **GEORGE J. GREENAWALT**
NESDEC Research Assistant

assisted by **DONALD P. MITCHELL**
NESDEC Executive Secretary

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Longfellow Hall, Appian Way
Cambridge, Massachusetts 02138

PREDICTING SCHOOL ENROLLMENTS

FOREWORD

Planning ahead is one of the main responsibilities of the school administrator. Planning for facilities is one of the most important aspects of planning ahead, and the one in which mistakes are the most costly. Anticipating how many children, of what ages, and with what needs, school facilities will have to serve in future years is a constant problem in school planning. NESDEC developed this report to guide the thinking of schoolmen planning for these future needs, to increase their perspective of the factors involved, and to stimulate their critical analyses of both the methods used to predict future enrollments and the predictions themselves.

Unfortunately, due to other pressures on the NESDEC staff, the release of this report has been considerably delayed from the time of its development (1961-1963.) However, no comparable publication has appeared in the interim and we feel that the information it contains is still extremely useful and the statistics in the first chapter, though not current, serve as helpful illustrative material.

Richard H. Goodman
Executive Secretary

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Chapter 1: A STUDY IN INACCURACY

School Construction and Population Increase

Each year the public schools of the United States commit billions of dollars to school construction. In the school year 1959-60, $2.7 billion were spent to provide classroom space.[1] In the past nine years the public has invested over $19.2 billion in school buildings. This extensive construction is the result of pressures that have been exerted on existing school facilities by wave after wave of children moving through the grades. And this population surge will be repeated in the years ahead as "war babies" form families and in turn have children.

School administrators are acutely aware of the need for proper long-range planning to meet these increases in school enrollment. Without such planning half-day schedules and double sessions may be required.[2] But when plans must be drawn up specifying school location and school capacity, the school administrator is confronted with another problem. How many children will attend a school in a particular location and how many will be in each grade? In other words, what is the school enrollment forecast?

Types of Forecasts Used

The 1949 AASA Yearbook[3] lists four major kinds of methods: ratio techniques, graphic techniques, Bell Telephone method, and use of analogy. Thomas C. Holy[4] lists six adding analysis and multiple factor methods. James D. MacConnell[5] gives us eight by splitting a couple of methods into sub-methods. Perhaps the most usable classification is developed by the University of Maryland's Studies in Business and Economics[6] which present four: the graphical, the mathematical, comparisons among series, and composition analysis.

The general type of forecast method that has gained widest use by educators and educational consultants is composition analysis. More specifically,

 a particular technique or its modification has become very widely used, known

by a variety of names... percentage of survival, percentage of advancement, percentage of retention, the Ohio State method, the NESDEC method, and the method used by the New York Commission on School Buildings.

Because the percentage of survival technique (hereafter referred to as the P-S Method) does have such wide currency and seems to be rather uncritically accepted by those using it, and because a substantial number of forecasts using this method are available, it is the method that will be examined in this study.

Extent of Previous Studies and Accuracy of Forecast Methods

Before undertaking examination of the P-S Method, it must be stated that, to date, forecasting techniques used by school systems have not been rigorously examined. Since 1925, there is a record of only a few studies directed toward an evaluation of the various types of forecasting methods. Jacob S. Segiel[7] has characterized these evaluations as far from satisfactory. Little evidence is available concerning the accuracy of forecasting methods. What evidence there is seems to indicate that all methods are susceptible to startling errors under certain conditions.

This lack of empirical evaluation of forecasting accuracy would be disturbing to school administrators by itself, but, in addition, several authorities have attacked the whole conceptual underpinning of small area forecasting. John Hajnal[8], Jacob Segiel, and others have despaired over the possibility of producing acceptably accurate population forecasts for small areas. Even national and state population forecasts, considered surer than those of small areas, have in the past missed the mark by embarrassing margins. In 1930, W.S. Thompson and P.K. Welpton, forecasters of high repute, predicted that the 1960 population of the United States would be between 137.9 million and 167.3 million.[9] The 1960 census figure is 179.3 million excluding armed forces overseas. Even allowing themselves a 40% leeway in the forecast Thompson and Welpton failed by 12 million people to predict the population.

If a national forecast can err in such fashion, what are the potentialities of error in a forecast for a very small area? Is it not possible that school administrators may place too much confidence in enrollment forecasts? How accurate has the popular P-S Method proven to be? It was the desire to shed light on these questions that led the New England School Development Council to undertake this study.

Design of Study

LENGTH OF FORECAST AND NUMBER OF METHODS TO BE STUDIED. In the past, studies of enrollment forecasts have been concerned with comparisons of two or more methods. The total number of cases has often been small and the number of projections by any one method has necessarily been even less adequate. In addition, these evaluations have made no attempt to compare forecasts projected over the same period of time. This has made it difficult to determine if one forecast method was "really" more accurate than another or whether "outside" historical and economic factors were working for one forecast and against another. Helen R. White[10] found the two identifiable factors that seemed to most affect accuracy to be length of forecast and size of population base for which the forecast was made. Thus, the study designs of existing evaluations place severe limitations on inferences about accuracy that can be drawn from them.

In an effort to overcome some of the more obvious limitations of prior studies, it was decided that only one forecast method, the P-S Method, would be evaluated, and that length of forecast would be held constant as would the historical era over which the forecast was made.

APPROACH USED IN THE STUDY. The approach used in this study is two dimensional. The primary concern is to determine the accuracy of a particular enrollment forecasting method (the P-S Method) projected over a certain length of time, in 242 towns and cities of Massachusetts.

The second concern of the study deals with the attempt to identify certain factors that seem to be associated with accuracies and inaccuracies in this forecast method. It was determined on an a priori basis that the following factors might be associated with accuracy of a forecast: size of total population base, size of school population base, relative change in these two over a respectively ten year and seven year period, and the relative size of migration that the community experienced in a ten year period that included the forecast era.

Selected communities that evidenced a sharp deviation from reasonable accuracy of forecast were investigated on an individual basis to see if some of the forces that caused inaccuracy could be discovered and dangers inherent in the P-S Method pointed up. Comments made by representatives of the school systems involved appear in the appendix to this chapter.

DATA FOR THE STUDY. Data for the study were drawn from several official governmental sources. The Commissioners of Education in each of

the New England states were contacted to determine if enrollment forecasts were made by a state agency for the various school districts. It was found that in Massachusetts this was done by the Massachusetts School Building Assistance Commission. Other New England states have no system of enrollment forecasting done by a state agency. Through the kind and interested cooperation of Simeon J. Domas, Administrator of the Massachusetts School Building Assistance Commission, school enrollment forecasts for 242 towns and cities from 1952 to 1959 were made available. Population figures for 1950 and 1960 came from reports of the U. S. Bureau of Census and the Massachusetts Department of Commerce, as did figures on net migration between 1950 and 1960. School enrollments came from the Massachusetts Department of Education Annual Report.

Appreciation is extended to John Alman, Director of the Computer Lab, Boston University, for his skilled help and advice in the statistical treatment of the data.

How Good is the P-S Method?

The P-S Method involves a relatively simple concept which assumes that certain factors influencing enrollment will continue to operate in the future as they have acted in the past. The factors that are assumed to remain in a constant relationship to each other are:

Death rate of children

Migration of pupils in and out of the community

Retardation policy

School dropouts

Movement of students to and from non-public schools.

If any one of these variables should change in a way not proportional to the movement of the aggregate of the variables, one of the basic assumptions of the method would be invalidated. These variables do not always move together. It cannot be assumed that "what happened in the past will continue to happen in the future, only more so". For example, the population of Boston decreased by 104,000 between 1950 and 1960. If this rate of decline were projected into the future, the "Hub of the Universe" would be completely depopulated in seventy or eighty years. This is, of course, ridiculous. A trend

line cannot be extended unthinkingly into the future without soon making the reducto ad absurdum obvious. This, by the way, is a criticism that strikes not only at the P-S Method, but at most of the other methods of forecasting.

What is Accuracy?

There is no generally agreed upon definition of acceptable forecast accuracy to be found in the literature. However, Leo Chamberlin and A. B. Crawford[11] have stated that an error of 10% is tolerable if the forecast is extended over a sufficiently long period. Accordingly, it was assumed for purposes of this evaluation that if a forecast, having run for seven years, predicted enrollment within plus or minus 10% of the actual enrollment, it would be considered "accurate".

Comparison of projected enrollments and actual enrollments revealed that of the 242 forecasts available to the study, 149 were, by this definition, inaccurate. Thus it appears obvious that the P-S Method does not merit the faith and confidence that many people have placed in it. On simply a statistical basis a community that used the P-S Method with uncritical acceptance would stand less than a 40% chance of getting a reasonably accurate forecast. This fact should give school men and forecasters pause, making them more aware of some of the limitations of enrollment forecasting.

One might ask if there is any indication as to which kinds of communities are forecasted accurately and which are forecasted inaccurately. In the following discussion an attempt will be made to answer this. To this end the variables of community size, relative net migration, relative population change, and relative enrollment change will be observed as they relate (or fail to relate) to the percentage of forecast error.

In examining the data, one fact is strongly evident: the tables all show very clearly that the P-S Method is highly inaccurate in a number of communities and that forecasts of enrollment missed the mark by a startlingly wide margin more times than it came close.

Presentation of the Findings

RELATIONSHIP BETWEEN (RELATIVE) ERROR AND (RELATIVE) COMMUNITY SIZE. It will be recalled that one of the hypotheses to be tested was the assumed inverse relationship between the relative accuracy of the P-S Method and the size of the community for which the forecast was being made.

Table I: Relationship Between Error and Community Size (Relative Measurement)

% of Error (Relative to # of Children in Forecast)		COMMUNITY POPULATION Under 2,500	2,500 to 4,999	5,000 to 9,999	10,000 to 14,999	15,000 to 24,999	25,000 to 49,999	50,000 to 99,999	100,000 or over	Total Communities
40% or more	under-estimation	3*		1	3					7
20 to 39.9%		7	4	10	10	2	2	1		36
10 to 19.9%		9	4	8	4	5	6	2		38
1 to 9.9%		5	8	14	5	7	8	2	1	50
0 to 9.9%		7	6	8	6	4	7	3	2	43
10 to 19.9%	over-estimation	11	6	1	2	1		2	1	24
20 to 39.9%		9	4		1			1		15
40 to 59.9%		4	3			1				8
60 to 99.9%		14		1						15
100 or more		6								6
Total Communities		75	35	43	31	20	23	11	4	242
# of "acceptable" (± 10%) Forecasts in each Community Size Group		12 or 16%	14 or 40%	22 or 51.2%	11 or 35.5%	11 or 55%	15 or 65.2%	5 or 45.5%	3 or 75%	93

*Number of communities falling within category

Number of communities with ± 10% forecast accuracy

In other words, it was supposed that the method would have a tendency to be more accurate in larger communities and less accurate in smaller ones.

The basic reasoning behind this assumption is that internal errors would have a tendency to cancel out in the larger communities thus giving greater accuracy.

Table I presents the data relating community size to relative accuracy of forecast. It can be seen that the overall range of error is very great. In only 93 of the 242 forecasts was error kept within plus or minus 10%. Thus the greatest share of all the forecasts failed to predict with even "acceptable" accuracy. (Some question, of course, might be raised as to whether forecasts that held errors to less than the 10% can really be called accurate. School administrators are called upon to provide classroom facilities for every child who attends school, not for an arbitrary 90 or 95 percent of them. Although it is true that there is some flexibility in building capacity through the device of overloading teachers, this is undesirable educationally and at times not possible because of already overcrowded conditions.)

From observing the row of columns showing the number of "acceptable" forecasts in each community size group, it can be seen that the P-S Method has the lowest percentage of accuracies in the smallest communities with less than 2,500 population and the highest percentage in the largest communities of 100,000 and over, as had been assumed.

There is also an apparent tendency for the P-S Method to overestimate future enrollment in the smallest communities and to underestimate enrollment for medium sized communities in the 5,000 to 15,000 population categories. When it is remembered that it is the communities in this latter group that have in the past few years experienced large increases in population and where pressures on school plant capacity are the greatest, it seems clear that the P-S Method actually works least well where it is most needed.

RELATIONSHIP BETWEEN (RELATIVE) ERROR AND (RELATIVE) MIGRATION. It can be said that variation in relative net migration "explains" about 10% of the variation in relative error. (The correlation between these two variables is .34.) This relationship is not strong, but it is suggestive of the inadequacy of the P-S Method in communities experiencing a high degree of migration.

Net migration, of course, can be either into or out of a given community. Table II reveals a phenomenon not obvious if just the correlation of .34 were to be considered. Closer relationships exist between relative error and relative net migration in some quadrants than in others. For example, there is a distinct tendency in the upper right hand quadrant for negative error (an underestimation of enrollment) to increase as the relative net in-migration increases. This is another way of saying that in those communities that have experienced relatively large increases in population due to in-migration the P-S Method has tended to underestimate enrollments.

Table II: Relationship Between Error and Migration (Relative Measurement)

% of Error (Relative to # of Children in Forecast)		% OF MIGRATION OUT OF AND INTO COMMUNITY (RELATIVE TO COMMUNITY SIZE)									
		20% or more	10% to 19.9	1% to 9.9	0% to 9.9	10% to 19.9	20% to 29.9	30% to 39.9	40% to 49.9	50% to 99.9	100% or more	Total Communities
		out-migration			← in-migration →							
40% or more	Under-estimation		1				1			2	3	7
20 to 39.9%		1*	1	4		6	3	6	4	9	2	36
10 to 19.9%			2	8	8	5	5	3	3	4		38
1 to 9.9%		1	5	10	15	5	4	3	2	4	1	50
0 to 9.9%	Over-estimation	1	8	10	7	3	6	2	4	1	1	43
10 to 19.9%		1	3	9	3		5	1	1		1	24
20 to 39.9%			1	5	2	4	2			1		15
40 to 59.9%				4	1	2	1					8
60 to 99.9%		2	3	2	2	5			1			15
100% or more				4	1			1				6
Total Communities		6	24	56	39	30	27	16	15	21	8	242

*Number of communities falling within category

RELATIONSHIP BETWEEN (RELATIVE) ERROR AND (RELATIVE) CHANGE IN SIZE OF POPULATION. Glancing at Table III one would expect to notice a similar relationship between relative error and relative population change to that which exists between relative error and relative net migration. This is confirmed by the fact that the same correlation (. 34) exists. Also, once again the upper right hand quadrant seems to indicate the greatest relationship between the variables. This is yet another statement that the P-S Method is most likely to underestimate school enrollments in those communities that have experienced a relatively large population growth.

RELATIONSHIP BETWEEN (RELATIVE) ERROR AND (RELATIVE) CHANGE IN SIZE OF SCHOOL ENROLLMENT. Table IV focuses on a relationship that is perhaps under closer observation by school administrators. Up to this point enrollment forecast error has been related to changes taking place in the total population of the community. Now by looking at relative enrollment change, it is possible to get at a primary concern of the schools: is the accuracy of the P-S Method related to the amount of change taking place in actual enrollments ?

Table IV confirms the fact that there is quite a high relationship between the inaccuracy of a forecast for a given community and the relative change in its school enrollment. (This correlation is . 67.) It can be seen that as a school system has increased in enrollment, the P-S Method has tended to produce larger and larger inaccuracies. In general, positive changes (increases) in enrollments have tended to produce underestimations of future enrollment, and negative changes (decreases) have tended to produce overestimations.

Simply stated, if a school administrator sees that his pupil enrollment is varying from a previously established pattern he must be alert to the fact that his forecast is likely to become highly inaccurate. This is a common sense approach, but one all too often not followed.

What Does All This Mean?

All this discussion about relationships between different variables is likely to leave the practicing school man with the feeling that it is perhaps of theoretical interest, but that the whole business doesn't seem to have much application to his specific situation. In a sense, of course, this is correct. It is impossible, when dealing with a large number of cases, to make any statements that will hold true for every community. However, the type of information presented is actually very practical, for behind the abstract figures of relative forecast error stand the classrooms that were needed and

Table III: Relationship Between Error and Change* in Size of Community Population (Relative Measurement)

% of Error (Relative to # of Children in Forecast)		% OF CHANGE IN COMMUNITY POPULATION (RELATIVE TO COMMUNITY SIZE)							
		10% or more	1% to 9.9	0% to 9.9	10% to 19.9	20% to 29.9	30% to 39.9	40% to 59.9	60% to 79.9	80% or more	Total Communities
		Smaller Population 1**						Larger Population →			
40% or more	Under-estimation	1	1	3	2	1			1	4	7
20 to 39.9%				7	8	2	4	9	5	9	36
10 to 19.9%			2	12*	10	6	4	7	2	2	38
1 to 9.9%		1	6*			5	3	6	3	4	50
0 to 9.9%	Over-estimation	2	8*	9*	4	5	4	4	4	3	43
10 to 19.9%		2	3	9	2	2	1	4		1	24
20 to 39.9%			4		4	4	1	1		1	15
40 to 59.9%				4		3		1			8
60 to 99.9%		2	3	1	3	3	2	1			15
100 or more				4	1			1			6
Total Communities		9	27	49	34	31	19	34	15	24	242

*Due to migration, births and deaths
**Number of communities falling within category

Table IV: Relationship Between Error and Change in Size of School Enrollment (Relative Measurement)

		% OF CHANGE IN SIZE OF ENROLLMENT (RELATIVE TO TOTAL ENROLLMENT)												
% of Error (Relative to # of Children in Forecast)		30% or more	20% to 29.9	10% to 19.9	1% to 9.9	0% to 9.9	10% to 19.9	20% to 29.9	30% to 49.9	50% to 99.9	100% to 199.9	200% or more	Total Communities
		← Smaller enrollment →				← Larger enrollment →							
40% or more	Under-estimation					1				1	2	3	7
20 to 39.9%				2		2	1		3	17	11		36
10 to 19.9%						1	2	4	14	16	1		38
1 to 9.9%						2	5	10	21	12			50
0 to 9.9%					2	6	9	9	9	7	1		43
10 to 19.9%				1	4	4	8	1	3	2	1		24
20 to 39.9%		1*	2	1	1	7		2	1				15
40 to 59.9%		1	2	2	1		2						8
60 to 9.9%	Over-estimation	3	4	3	2	3							15
100 or more		4	1	1									6
Total Communities		9	9	10	10	26	27	26	51	55	16	3	242

*Number of communities falling within category

perhaps not built because the forecast underestimated the need.

Table V shows that the P-S Method failed to forecast accurately in a high percentage of the communities, and this failure translated in terms of actual children was enormous. Arbitrarily assuming that a forecast which misses its mark by anything more than 100 students either way is inaccurate, we find that 128 communities would have failed to provide adequate facilities for their new children. In a number of communities it can be seen that the P-S Method failed to predict the appearance of from 500 to 2,000 children!

Perhaps the most outstanding example of this phenomenon can be found by citing Springfield as a hypothetical case. Here is a community for which the P-S Method would have produced a forecast underestimating future enrollment by "only" 9.5%. Yet when this is translated into actual classroom space, it is evident that the forecast would have underestimated actual enrollment by 2,793 children. The number of "forgotten" children themselves constitutes a medium sized school system. If the P-S Method had been depended on to predict the schoolhouse needs of Springfield, approximately 100 classrooms would not have been built that were proved to be needed by the actual appearance of the children in school. (See Appendix I)

Other examples of the magnitude of absolute error produced by "small" relative error can be cited. Haverhill with a 9% error would have failed to provide for 610 children, Belmont with 12% error would have under-predicted by 570 children. Still more examples can be added that merely clinch the fact that in the final analysis the school administrator must be concerned about the absolute accuracy of a forecast method used even more than he is about its relative accuracy.

Summary

What general conclusions, then, can be drawn from the preceding discussion? The data seem to indicate several things.

1. The P-S Method produces the greatest error in those fast growing communities that most need accurate enrollment forecasts.

2. Enrollment change is a pretty good predictor of forecast accuracy. Corollary: Keep a sharp eye on enrollments to note changes and trends, for if enrollment begins to change rapidly, the forecast very likely will become inaccurate.

3. In larger school systems a forecast that is technically "accurate" (within 10% error) may be inaccurate by several hundred or even several thousand students.

Table V: Relationship Between Error and Community Size (Absolute Measurement)

	Absolute Forecast Error	COMMUNITY POPULATION								
		Under 2,500	2,500 to 4,999	5,000 to 9,999	10,000 to 14,999	15,000 to 24,999	25,000 to 49,999	50,000 to 99,999	100,000 or over	Total Communities
Underestimation	2,000 pupils or more						1	1	1	3
	1,000 to 1,999				3	1	2	2		8
	500 to 999			3	7	3	6			19
	300 to 499			5	5	3	2	1		16
	100 to 299	1*	8	13	6	5	4			37
	1 to 99	23	8	12	1	2	1	1		48
Overestimation	0 to 99	40	11	6	4	1	4			66
	100 to 299	9	8	3	4	3	1	2		30
	300 to 499	2		1		1	1			5
	500 to 999				1		1		2	4
	1,000 to 1,999					1		4		5
	2,000 or more								1	1
	Total Communities	75	35	43	31	20	23	11	4	242

*Number of communities falling within category

communities predicting enrollment within ± 100 pupils

Chapter 2: FACTORS AFFECTING SCHOOL ENROLLMENTS

It has been demonstrated that the forecast method used by large numbers of school officials (the P-S Method) was, in the case of Massachusetts from 1952-1959, highly inaccurate in a majority of its projections. Further, by looking more closely at a few of the communities in which the P-S Method produced a large amount of error, some of the factors that can operate to change trends were identified. What then should the school administrator do? Enrollment forecasts must be made. Planning must precede building, and knowledge of needs must precede planning.

THE INVESTIGATION OF ASSUMPTIONS. For both the forecaster and the school superintendent the beginning of forecast wisdom comes with the birth of a critical approach. One of the purposes of this report is to arouse a searching, analytic attitude toward at least one forecast method, the P-S Method. It can also be categorically stated that no forecast method should be accepted and applied blindly to a community. School administrators must see consistently high forecast accuracy for the myth it is. Any type of prediction, especially involving human beings, is a chance thing; there is no magic formula in spite of the fact that finite figures written in a report can appear extremely authoritative.

After the development of a general skepticism toward all methods of forecasting, assumptions must be investigated; the school administrator must be able to see what he is buying. Often there will be no objective test of the reasonableness of the assumptions upon which forecasts are based, but this should not deter the superintendent or responsible school authority from applying his own best judgment. If, after careful thought, the method seems to fail to take into account the realities of the local situation, it should be discarded or modified accordingly.

How can a school official, himself not a forecast expert, hope to properly examine basic assumptions of a forecast method? To use an educational cliché, the superintendent must know his community. Here "community" does not simply refer to the local community, but the area, the state, the region and the nation. Changes elsewhere will affect the local community. The perspective of the school administrator and the enrollment forecaster must be extended beyond the political boundaries of the town, city, or school district.

What are the factors operating in the community (as broadly defined) that

the superintendent must be aware of? Compilation of a definite and exhaustive list would appear to be impossible, for new factors will probably appear in the future that do not now affect any community and perhaps cannot even be dreamed of at present. However, it is hoped that the following list will touch on some of the factors involved. They are grouped under four classifications:

Factors affecting the number of dwellings available in the community.
Factors affecting the type of people living in those dwellings.
Factors affecting the demand for dwellings in the community.
Factors "controlled" by public and non-public schools.

Let us examine each of these categories separately.

The Number of Dwellings Available in the Community

In this category, a community's ultimate capacity for carrying population, also referred to as community saturation, must be considered as this will largely determine the upper limit of the number of dwellings. Tens of thousands of persons per square mile are possible (even if not desirable) under certain conditions like those found in Manhattan. Although the theoretical carrying capacity of the land is not known and will vary greatly from community to community, certain factors that have decided effects on both the ultimate population and the number of dwellings in a community are known.

One of these factors is the quality of land available for development. For example, as the larger tracts, with topography and soils that lend themselves to economical building, are used up, additional housing, if it is to be produced, must come from more and more marginal land. This land is often much more expensive to develop and in the natural course of things may remain largely undeveloped. However, a steep hillside, a ledge outcropping, or a swamp can and might well be utilized for housing and therefore must be considered by the school administrator when estimating ultimate land potential.

If a community still has a good deal of undeveloped land within its borders, it may be utilized by subdividers or developers, or it may be broken up into small separately owned parcels, where development will in all probability proceed more slowly, and be of a different character from that of the big developer.

Zoning regulations also affect ultimate population and number of dwellings.

Through manipulation of lot size and frontage requirements, the total carry-

ing capacity of the land can be arbitrarily and quickly changed. Zoning can be used to accelerate or slow down rate of growth. Some studies[12], however, seem to indicate that zoning, at least in the Metropolitan Boston area has less effect on rate of growth than it does on the character of that growth. If, for example, a community experiencing a large influx of new housing construction moves from 15,000 sq. ft. residential zoning to 30,000 sq. ft., rate of growth may diminish somewhat, but property becomes more expensive and demands that a more expensive house be built. It is probable that a different type of family will buy the house, with a different family composition than the family buying a less expensive house.

Many older and larger communities are committing themselves to urban redevelopment and renewal. Because this is a relatively new experience to community planners and students of population in the United States, it is difficult to predict exactly what will be the effect on community population and school enrollment. Differences of opinion exist. Some planners feel that if urban renewal proceeds as it has with the elimination of slum dwellings and the building of expensive high rise apartments, the families with school age children will leave the central and inner-ring cities in ever-increasing numbers. They will be replaced with older families of a higher socio-economic level containing few if any school aged children. On the other hand, some city planners and school authorities feel that if planning and construction of new school facilities can be integrated with urban redevelopment and renewal, there is a possibility that families with school aged children can be anchored to the community. In any event the school administrator cannot ignore urban renewal if it is taking place or is likely to take place in his community.

Still another factor that affects and can change the ultimate population capacity of a community is the conversion of dwellings from single family to multiple family occupancy. Thus, even in communities that are completely built up, size and composition of population can change quite significantly over a period of time. The school administrator should be alert to the renovation, remodeling, and conversion that is taking place in his community.

Availability of financing, including the mortgage rates being offered by Savings and Loan, FHA, and the banks, can have an important effect on the availability of housing in a community. Any movement to reduce mortgage rates, make mortgage money easier to secure, or to extend the time over which a property may be mortgaged will have a stimulating effect on house construction and, indeed, on business activities in general. The influence of financing on housing does not mean, of course, that home construction will be determined by interest rates. If no one wants to buy, low rates and extended terms will have little effect on construction. Conversely, during a real building boom, even a tightening of financing restrictions will not discourage many people from going right ahead and buying.

The Type of People living in Dwellings

This refers to the composition of the families that live in the community and, more specifically, the proportion of school aged children in those families.

It is readily apparent that family size can vary greatly. Likewise two families of the same size may have different numbers of school aged children or may have different numbers of children in the public school. It can be quickly seen that facts about family size and composition as well as vital information about the family's economic and social background and educational plans for their children must be available to the school administrator who is interested in enrollment forecasting.

Communities, sections of communities, and even dwellings may pass through what is known as the "housing cycle"[13]. This cycle should not be considered a predestined occurrence; yet, in a surprising number of instances, it has been found to hold. Birthrates, family composition, and public vs. non-public school attendance may change significantly as a dwelling, neighborhood, or community passes through this cycle.

In the first phase, it has been found that 75% to 85% of all new urban dwelling units are initially occupied by couples in the first five years of married life. (Exceptions to this would be found in expensive suburban developments where it is usually the second five years of married life.) New housing does not deliver its maximum impact on school facilities at date of completion; but from five to ten years after completion.

During the second phase, which covers the second fifteen years, birth rates are low and high school enrollments are large compared to declining elementary enrollments. Toward the end of this phase high school enrollments will also tend to decline.

A change in the population of the neighborhood characterizes the third phase. The older inhabitants tend to move out and are replaced by the families of lower cultural and economic status. The incoming families are usually younger causing the number of school age children to increase again. Public school enrollments may climb gradually depending on availability of non-public school facilities.

The fourth and last phase of the housing cycle is characterized by blighted areas which become slums. Along with deterioration of the property comes large scale population movement. School enrollments may once again shoot up over a period of just a few years.

There may be a post-fourth phase in some communities and neighborhoods. This has happened in areas like Georgetown and some places in New York City. Urban redevelopment and renewal, as has been indicated, are

imponderables, but will surely play a part in the post-fourth phase.

Different types of dwelling units in a community produce different types of families and numbers of children for the public schools. It makes a great deal of difference whether the new construction taking place in a community is of the single family dwelling type, the two, three or four family type, or the larger multiple units. A family, particularly a young family moving into a multiple family dwelling, is likely to be very mobile. Often the family moves in with small pre-school children and will not stay long enough for the children to enter school. A public housing development may contain a staggering number of children, yet few of the children will ever attend school in that neighborhood. Often young families move out of this type of housing as soon as they are able, to be replaced by other families with many pre-school children, and few school aged children.

It cannot be assumed that a community will display as stable a pattern in the future as it has in the past. A public housing development might be transferred to private control, or apartments that were owned by a large investor may become cooperative. These changes are likely to affect the type and size of family that will live in the dwellings. By making a typical transient apartment development cooperative, it might well be that people with lower mobility would take over the dwellings. Birth rates would very likely be affected as well.

FAMILY COMPOSITION. The family composition of the population may be affected by forces acting in society at large. For example, marriage patterns have undergone and are still undergoing changes in the United States. In the last twenty years the age at which families are formed has dropped dramatically. In the 1930's, women were first marrying in their middle and late twenties. Now the average age of women marrying for the first time is closer to nineteen or twenty. This has had an effect on birth rates and size of families. Factors such as this have relevance for the school administrator in predicting school enrollments.

New industry may move into the community or into a nearby community and bring with it families whose composition differs from the older residents. It is not unusual for an essentially rural community to be converted to an industrial or residential community through the growth of industry and the movement of population from a larger community. Communities that were small industrial towns have been changed in the course of just a few years, to "bedroom" communities for larger nearby industrial cities.

Often change in family composition can negate or modify the effects of zoning ordinance changes. For example, in a community where lot sizes are already large, a further increase in lot size may actually bring in more, rather than fewer, children. This could take place when lots, that formerly permitted the upward striving middle class family with two or three children to locate in the community, are changed so that only substantially wealthier

people could afford to buy. It might well be that today the very well-to-do families, headed by a probably somewhat older breadwinner, may actually have more children, and more children in school, than the typical white-collared, salaried employee.

The Demand for Dwellings in the Community

What is being discussed here is effective demand. In other words, there may be a great potential demand for housing of all sorts, but in order to have an influence on the movement of population it must be translated by the availability of money into effective demand.

The first great determiner of housing demand in a community is the general level of business in the area, region and nation. It is true, of course, that a community may move against the general economic trends of larger areas. A local community may be experiencing a depression while the national economy is buoyant; or a region or state may be depressed while a community within that region is prosperous. However, the local community is usually linked with the area, region and nation to a large extent, and economic movements elsewhere have a heightening or dampening effect on local conditions.

One of the factors that operates on the demand for housing in a community is a governmental installation. Military bases are the most obvious examples of the movement of the federal government into an area. However, the federal government's activities are not limited to the military. The Atomic Energy Commission and the National Aviation and Space Administration have affected vast population changes in communities where it has set up operations.

Demand factors do not have to be working directly on the community to affect a change in population. Because of the interrelatedness of communities, particularly those that share a common transportation network, an industry moving into one sector of the network can affect many other communities. Illustrative of this interdependence of communities is the cluster of industrial and residential towns in the Route 128 complex surrounding Boston. Here it is possible to find industry that may draw its labor from many miles around. In the coming age of the inter-state highway system even more distant communities will be economically linked together.

Public and Non-Public Schools

Non-public schools have an easily recognized influence on public school enrollments. Decisions to build or not to build by non-public schools are

the most obvious of these factors. However, non-public schools can change admittance policies, or they can decide to drop some grades in their schools and add others. Parish boundary lines may be changed, or regional or diocesan schools may be built. Hard as these changes may be to predict, the school administrator must be alert to possibilities of change in this direction.

Finally, there are a number of policy decisions that are made within the school system itself that affect student enrollment. The number of children that will advance from grade to grade will be conditioned by school attitudes toward retention, the type of educational program offered students, and academic standards in general. In addition, of course, dropouts are also conditioned by general economic factors. If a school program makes little provision for the needs of the slower student and he is readily able to find a job in the economy, dropout rates will tend to increase.

Changes in school district boundary lines or school district consolidation can have a dramatic effect on school enrollments. A more subtle, but nevertheless real, factor affecting school enrollments is construction of new school facilities themselves. The drawing power of modern school facilities extends not only to individual families looking for a community in which to locate, but also to industry that is mindful of the educational aspirations of its executives.

Chapter 3: SOURCES OF INFORMATION FOR FORECASTING

When the school administrator becomes aware of the importance of factors affecting school enrollment, where is he to secure the needed information? Fortunately, there are a number of good sources of information available. Some are little known and utilized; they need to be explored and incorporated into a program of information collection.

Many of the factors which effect school enrollment are the direct concern of governmental, quasi-governmental, and private organizations. These organizations conduct surveys and studies in their fields of specialized interest, often publishing their findings. In many cases, the school administrator can avail himself of these publications by merely asking to be placed on the mailing list. In other instances, the organizations have valuable information that is compiled but not formally printed and is usually made available to schools if requested.

Other governmental units and private organizations can also provide information to help the schools do a better job of planning. It seems that all too often in the past, schoolmen have not realized how vital and available community information can be to them. Perhaps there has been a natural diffidence on the part of school administrators to request information that might inconvenience these organizations. However, in most instances, there is an active desire on the part of governmental agencies and private organizations to provide schools with the best possible information. It is the purpose of this section to provide some suggestions for establishing regular channels of communication to obtain valuable community information.

Information on Potential Land Use and Availability of Housing

In many communities today there are a number of agencies concerned with building, land development, and ultimate land use. The local planning committee plays a key role in determining the ultimate carrying capacity of the land, the basic nature of the community, and the rate at which development will take place. Direct contact with the zoning bodies should be main-

tained. This can be done by requesting copies of tentative plans as well as the final decisions of the zoning board. Personal contact is an even better method because the school administrator can often see changes taking place in advance, and if formal plans and decisions are contemplated, communication can become more close and formalized as conditions develop.

Local and regional planning bodies are another splendid source of information. These bodies often meet on a regularly scheduled basis, so by requesting copies of meeting minutes plus contacts with members, the superintendent can stay up to date on planning changes. Regional and state planning agencies often conduct studies and surveys of population, land use, and economic development. These studies may be obtained by the superintendent and used as sources of information about the larger "community" of which the local community is a part.

In larger communities urban redevelopment and renewal authorities should be contacted. Formal liaison should be established between the schools and these authorities, for the schools need to know their plans and objectives as well as to take part in helping to shape the plans involving schools in the redevelopment areas.

Builders and subdividers play an obvious role in the development of housing. Although constant communication with private builders and contractors is probably not necessary, it is imperative that, at regularly scheduled intervals, the superintendent or someone he designates determine builders' plans for the coming year. Many builders plan developments on a fairly short-range basis, but some of the larger builders have long-range plans for building in communities, areas or even states. Discussions of a general nature with these large builders can be very fruitful in determining trends in magnitude of building and in type of housing to be erected.

In this same group of private individuals concerned with the supply of housing are the realtors. Often these people are among the best informed in the community on matters concerning supply and demand of housing. Informal contacts with realtors in whom the school administrator has confidence can be of invaluable assistance.

Some communities provide water and sewerage facilities; others do not. If these facilities are provided and required for houses, water and sewerage authorities may often play a determining role in the development of new housing. These authorities have estimates of ultimate demand on their facilities as well as long-range plans for expansion of service. Short-run decisions to bring these facilities to a new area have great importance to the school administrator and contact should be maintained where appropriate.

Electric and telephone companies are important sources of information for two reasons. First, many private utility companies are themselves engaged in population forecasting. These studies and projections can be extremely valuable to the school administrator. Second, although electric and phone companies follow housing and industrial development, they also modify

and condition the direction and magnitude of that development. Often projected patterns of service installations will later be realized through the development of housing and industry utilizing those installations.

Financial decisions made by sources of mortgage money such as the Federal Reserve System and the Federal Housing Authority can have a profound effect on rate and magnitude of home construction. These agencies regularly publish reports and newsletters that can be secured by the school administrator. The Federal Reserve Bulletin for the New England area, emanating from the Boston Federal Reserve Bank, is a source of much valuable information relating to general business conditions as well as the activity of the home and industrial construction industry. From time to time the FHA, sometimes under the direction of Congress, makes decisions regarding mortgage rates and lengths of mortgages that can influence home building. On request these organizations will place the school administrator on their mailing lists to receive information regularly.

Permits for new housing starts are compiled and published by the Massachusetts Department of Commerce as well as the U. S. Department of Labor. These figures for local communities are available to school administrators and should also become a regular part of the body of information which he utilizes.

Probably every school administrator has his own sources of information. However the preceding list of agencies and organizations indicates that he probably still has many untapped resources. The list is far from complete but as these sources are contacted and used, more and perhaps better channels of communication will be uncovered.

Information on Population Characteristics

There exists one prime source of information concerning the types of people, family composition and mobility patterns in the local community. This is the annual school census. The United States and State Census can also provide much valuable information, but it is the yearly local census that best meets the needs of the school planner.

Some states require school districts to conduct an annual school census. Certain communities have set up their own program of information collection with a view to doing a better job of estimating future enrollments. Many communities have no such systematic, well organized program.

Attempts to organize an annual school census that will provide really useful information for school planning go back many years. These programs have had mixed value and results. In some cases, programs have been adopted for a few years and then dropped. The more usual pattern is found in a community that is engaged in a building need survey, where a careful school cen-

sus has been carried out on a one-shot basis in order to obtain data for the forecast growing out of the special study.

In the past, several problems have faced the school administrator who has seen the need for a systematic, organized method of data collection in his community. These included the problems of organizing the enumeration effort, lack of financial resources, lack of experience with census taking, and finally lack of knowledge of the specific information which should be collected and of the ultimate value of the information when it was collected. As a result, school administrators often know far too little about the make-up of the population of their community, the migration patterns into and within the community, and the number of children who will be attending public schools.

A number of educators and enrollment forecasters, including George D. Strayer, N. L. Englehardt, Wallace H. Strevell, Ralph McLeary and Arvid J. Burke, have emphasized the need for an accurate school census. Strevell and Burke have compiled a list of the minimum essential records that should be in the office of every school district. This list includes:

1. Summary and analysis of school census, including migration data.
2. Annual resident births.
3. New residential dwelling construction.
4. Studies of private and parochial enrollment.
5. Enrollment density by residential sectors of pupils attending public schools.
6. Analysis by both age and grade of annual changes in public school enrollment and holding power.
7. Index of school plant utilization.
8. U. S. Census and other wider area comparisons.

From this, several questions might reasonably be asked by the administrator interested in compiling this type of information: 1) How is an annual school census to be organized? 2) What type of questions should be asked? 3) What materials are needed? 4) How are enumerators found, trained, and supervised? 5) How much will a census cost?

Although it is not possible to construct a complete blueprint for a particular school system here, there are some generally accepted sound practices that every school administrator should make certain are included in the type of program planned for his particular community. (See also Appendix III)

HOW IS AN ANNUAL SCHOOL CENSUS ORGANIZED? The part the school administrator plays in organizing the school census will depend on staff resources, size of the system, and help available from outside the schools. In smaller school systems, it is likely that the superintendent will not only have to initiate the program, but also direct the setting up of its organization. In such cases he may work directly with community or teacher groups in explaining the value of the work and enlisting them in the enterprise. In larger systems the superintendent will probably turn the organi-

zation of the program over to a person in the central office connected with pupil accounting or building planning. In systems where central office personnel are not available, principals of schools might be tapped to handle this administrative job.

When organizing a school census remember that, in order to be effective, it must be a sustained effort over a number of years. The organization should be so constructed that even with changes in personnel the school census will continue from year to year. Further, record keeping must be systemized so that data collected by the annual census can be reduced to a form useful and accessible to the school administrator over a period of years.

WHAT TYPES OF QUESTIONS SHOULD BE ASKED? Three factors determine the usefulness of a school census: its accuracy, its timeliness and the kind of information it provides. Information is determined, of course, by the kinds of questions the census asks.

All too often in the past the school census consisted simply of determining how many school-aged children resided in the community. Many times no attempt was made even to find out if the parents planned to send their children to public schools. Obviously, this type of information should be included on a census form. In addition, information should be gathered on the types and age of housing the families are living in, on whether the housing is rented or owned by its occupant, and on how long the parents have been in residence, where they came from and when they anticipate moving in the future. From this information, migration and mobility patterns can be roughly blocked out.

WHAT MATERIALS ARE NEEDED? In order to conduct an accurate census school officials, team leaders and surveyors must be provided maps which clearly delimit work areas. Maps that can be reproduced and adapted might be obtained from local planning bodies, municipal and state authorities, or the Washington Distribution Section, Geological Survey, Silver Spring, Maryland.

Before the survey sheet can actually be developed, some basic decisions must be made on how the data will be drawn together, analyzed, stored and used, and whether the census data are going to be processed electronically or manually. If census data cards are only to be scanned occasionally then in terms of cost a manual system, such as the McBee Keysort system, would have a decided advantage.

However, in a school system of any size, manual compilation is almost out of the question. Here the electro-mechanical sorting and retrieval systems, such as IBM or Remington Rand, should be used to feed the data directly into computers in order to investigate patterns and relationships of factors affecting population change. Currently IBM is the system that is the most widely used and available.

Unless a school system is very large, it will probably not have IBM equip-

ment of its own. This is not a deterrent to using IBM supplies and methods as many industrial firms are more than happy to serve as computing centers, as are many of the larger institutions of higher learning. A number of school systems could work together to contract for machine time on a regularly scheduled basis. This could also be done by an individual school system, but economics of effort seem to indicate that an organization such as NESDEC or the New England Education Data Systems (NEEDS) could perform this coordinating function best.

HOW ARE SURVEYORS FOUND AND TRAINED? Communities have used many different groups of people as surveyors, such as PTAs, retired persons, housewives, part-time college students, and teachers. The type of person who will give the best results often depends on the community itself. However, there are some general standards of good practice that should be followed in any case.

First, the surveyors must be trained. They must be impressed with the importance of what they are to do and the need for accuracy. They must be instructed in techniques of information gathering, and be thoroughly familiar with the census form itself so they know precisely what each item means and fully appreciate the need for complete and accurate work. They should also be instructed in the use and reading of maps and become thoroughly familiar with the area they are to cover.

Second, surveyors must be supervised. The census must be so organized that a relatively small number of surveyors are under the direct supervision and observation of a skilled director.

Third, provision must be made for systematic checking on the accuracy of the surveyors. Even where a spot recheck of dwellings is not practical, it is possible to check surveyors' forms and reports for clerical errors. Some school censuses have house-to-house surveyors check other surveyors' work.

A valid school census cannot be constructed in a haphazard manner. It has been estimated that many school censuses in the past have resulted in errors as large as 20 percent. This type of error can be brought within tolerable limits through sould organization of the census enterprise and adequate training and supervision of all personnel involved.

HOW MUCH WILL IT COST? Relative cost is impossible to determine in a general way. It will vary for each community. However, it must be remembered that the cost of conducting an annual school census, together with proper use of the information, is related to what it would cost the school system if the work was not done. For example, if $5,000 a year is spent on a systematic program of information and data collection and this permits the school system to plan its construction program more intelligently thus eliminating a reduced school program or double sessions, then the real cost of a census may be zero. Poor school plant planning is one of the most costly

financial mistakes a school administrator can make. Any reasonable program of expenditure that can hold school plant planning mistakes to a minimum is worthy of serious consideration.

Once a census has been conducted, its records become the basis for the survey in succeeding years. Once the organization for the census is established, the relative cost of handling it is decreased and the experience gained each time the census is conducted leads to further sophistication about the process and a greater yield of useful data from the same general information.

Information on Factors Affecting School Demand

Perhaps the best sources of information about general business conditions are newspapers, news magazines, and financial and business journals. Personal contacts with individuals in the banking and business world will also provide valuable information about prospective local economic conditions. The school administrator needs to be sensitive to the changes and fluctuations in the business climate on both the local and national level.

Highways play a vital part in the movement of population and industry from one area to another. A Bulletin released by The Highway Research Board in 1959 shows clearly how certain industry moved from the central city of Boston to the new industrial ring built along Route 128. Highway and Public Works Departments are often willing to make general statements about future highway construction and although routes often cannot be pinpointed far in advance, general patterns can be seen.

Information on Public and Non-Public School Decisions and Policies

The school administrator must be aware of the system's policy decisions which affect school enrollment. However, this is sometimes difficult. Unless accurate records are kept of the number of children passed and failed each year by each teacher, it is very likely that the administrator has a mistaken idea of the retention ratio in his school system. In addition, without adequate records it is probable that some teachers are not observing system policy by either failing a very high proportion of students or by "passing everyone." These violations of school policy can be discovered through the records.

Adequate records of the number of dropouts not only permit the school administrator to do a better job of enrollment forecasting, but may also point up areas in the curriculum that need bolstering. A high dropout rate is a danger signal to the school administrator, more than likely meaning poor curriculum, poor guidance, poor instruction, etc. The school with good holding power usually has a wide and diversified curriculum to meet the educational needs of most of the students.

School enrollment factors affected by non-public school decisions are much more difficult for the public schoolman to anticipate. Often parochial school building plans are made, only to be modified as financial conditions change. Grades may be added one year at a time as money, space, and instructors become available. This pattern of development will have a different effect on public school enrollments than the opening of a building with many grades.

Parish boundary lines can change or regional schools be built. A school may decide to drop kindergarten and add 6th grade or vice-versa. It is wise for the public school administrator to maintain informal contact with non-public school authorities so that, as decisions are made, the superintendent can be better aware of the implications for school enrollment.

Conclusion

It would appear that the popular and widely used percentage of survival method of forecasting school enrollments must be used with great care by school administrators. This investigation has empirically shown that the P-S Method has been unable to produce the kind of accuracy that many have counted on. The P-S Method is most accurate in communities that experience little change in rate or direction of population growth. Because the method is insensitive to changes among the determinants of public school enrollments, however, it has far less application in communities that are not static.

The school administrator can tap various sources of information that should allow him to make better enrollment forecasts no matter what forecasting method is employed. Some of these sources have been presented. In conclusion the ancient admonition "know your community" is given to the school administrator who wants workable and reasonable enrollment forecasts.

Appendix I: FACTORS ASSOCIATED WITH POPULATION CHANGE IN SELECTED COMMUNITIES

After computing the relative and absolute enrollment forecast error for each of the 242 Massachusetts towns and cities, it was a simple matter to identify those communities for which the forecast was exceptionally inaccurate. It was felt that it might be possible in these communities to uncover some of the factors that produced forecast inaccuracy. Perhaps certain factors had been operating differently in the forecast period 1952-59 than in the period 1947-52 which was the base period.

To determine if persons watching enrollment change could help to identify these factors, letters were sent to a number of school systems that had been forecast very inaccurately. (See Appendix II)

There can be no claim that the factors identified in the several communities are the only factors that caused the actual enrollment to deviate significantly from the projected enrollment. Indeed, it is possible that some of the factors that are said to have had an influence actually did not. However, the discussion that follows is drawn from statements of school superintendents, their assistants, and planning persons. All of these people have a rather intimate knowledge of their communities.

Boston

Charles Lynch of the School Department's Office of Research identified several factors that have influenced school enrollments and forecast accuracy in Boston. Major among these are new highway construction and urban redevelopment. Mr. Lynch feels that the construction of arterial highways in the Greater Boston area, not those in the City proper, have served to draw industry and population from the central city.

Further, urban renewal has had a profound effect on the land use patterns and therefore on the composition of the population. Lynch stated that in some instances where residential property has been eliminated and the land used for commercial or industrial purposes, the former residents in many cases leave the city altogether.

Braintree

Here school authorities called attention to the fact that highway systems do not always cause people to come to a community. Ralph W. Proctor,

then Superintendent of Schools stated that the "highway takes people by Braintree". This points up the importance of examining each community for its individual growth patterns.

Pittsfield

Theodore Herberg, then Director of Research and Curriculum Department, Pittsfield Public Schools, indicated that a shift in the type of industry can also bring with it a change in the composition of the population. He pointed out that the closing of the textile mills, coupled with the expansion of ordnance manufacturing, brought an in-migration of specialized technical personnel.

Quincy

In Quincy several factors were identified by the then Superintendent of Schools, Paul Gossard. As might be expected, activity in government and military installations affect Quincy's total school enrollment. However it is found that although there are about 2,200 pupils involved in this category, enrollment does not fluctuate very much. Housing potential was increased in Quincy through the conversion of part of a golf course into a residential area. Speaking of the housing cycle Superintendent Gossard makes these comments:

> We discovered that the 'maturity' of a neighborhood makes a big difference. In some neighborhoods people whose children have left school continue to live in the old homes, with a resulting decrease in the number of children per thousand of school age.

Springfield

A number of factors were listed as affecting public school enrollments in Springfield: 1) Conversion of large, single-family residences into multiple housing units. 2) Demolition of houses for roadbuilding and expansion of shopping areas. 3) Building of non-public schools: Springfield lost pupils not only to the new large parochial high school but also to three new high schools in suburban communities.

In regard to development of real estate projects in Springfield, Helen N. Theinert, then Director of Research had this to say:

> The Planning Board informs the School Department of all approved developments. Sometimes building of homes progresses rapidly; other times plans seem to lie dormant for a rather long

period. One has difficulty in predicting the success of projects which may result in greatly increased school population in some school districts.

Sudbury

The Superintendent of Schools in Sudbury pointed up a factor influencing community growth that is sometimes overlooked. He stated:

> Basic to our in-migration has been the School Committee's policies which stress excellence of the school system. This factor has attracted significant numbers to the town..

Tewksbury

The Superintendent of Schools made several points in his response. His comments concerning service facilities and zoning are quoted here:

> The large increase in Tewksbury's school population was influenced beginning in 1952 by the fact the Town installed water mains for the first time. This coupled with the fact that surrounding communities were putting on building restrictions, made Tewksbury attractive to builders.
>
> A change to control of building was made in 1956 when the Town placed an acre lot restriction as the requirement for each home and adopted restrictions on the extension of water mains which effectively brought new building nearly to a halt. New home starts dropped from an average of 600 homes a year to 60.

Appendix II: SAMPLE QUESTIONNAIRE TO TOWNS WITH HIGH PERCENTAGES OF PREDICTION IN ACCURACY

Dear Sir:

The New England School Development Council is engaged in developing a handbook for school administrators on school enrollment forecasting to be published this fall. As a part of this project an analysis of the "percentage of Survival Method" will be included. This method, widely used by schoolmen in New England and other parts of the country, is also employed by the Massachusetts School Building Assistance Commission to determine an estimate of future building needs.

Two hundred and forty-two predictions were covered. The prediction period was from October 1, 1952 to October 1, 1959. The historical data used as the basis of this method covered the period 1947-1952. In the process of our analysis and evaluation of this method we have identified a number of communities where predicted enrollments deviated significantly from actual enrollments. We are beginning to believe that a number of factors may have been operating differently in these communities in the period 1952-1959 than in the period 1947-1952 to cause this inaccuracy.

By identifying some of these factors we hope to be able to alert school administrators and others concerned with enrollment forecasting to conditions that require modifications in the use of the "Percentage of Survival Method." We hope in this way to render a service to practicing schoolmen faced with practical decisions of when to build, where to build, and how much to build.

Your community is one that apparently has experienced a number of changes in the prediction period 1952-1957 which has made the forecasting process complex. If you can find a few minutes to respond to a series of suggestive questions concerning such possible factors that have been operating in your community, our study will be assisted considerably. This information will ultimately be shared with other school systems through the publication of the final report.

Enclosed is a list of some of the factors that may or may not have influenced change in your community. Would you use the list as suggestive only, remembering that some factors may have been operating in your community

and others may not. The list is far from exhaustive, so as other factors occur to you, would you please note them on the sheet and comment on them as you feel is necessary. If you are new to the community, you may wish to consult with the planning board, assessors or others in close touch with the community.

We have left room for your general comments on what you feel has been the most basic cause of enrollment change in the past ten years. Your responses in this section will be very valuable and we may wish to include statements by school administrators in a number of communities in our report. No quotations, of course, would be used without your express consent. An additional copy of the comment sheet has been included for your files.

Thank you very much for your time and consideration in this project.

Sincerely,
G. J. Greenawalt
Research Assistant

Letter and questionnaire sent to the following superintendents:

Ashland
Boston
Bourne
Braintree
Burlington
E. Longmeadow
Framingham
Groveland
Lexington
Longmeadow
Ludlow
Pittsfield
Quincy
Rockland
Shelburne
Springfield
Sudbury
Tewksbury
Wayland
Winthrop
Wrentham

Name of Community _____ Name of Respondent _____

New Factors in Community Change

Please Note: Probably not all of these factors have been operating in your community over the period 1952-1959. Each community usually has unique factors influencing change in population. Please react to those you think apply in your community and cross out those you see have had little or no influence. Your general comments at the end will be useful.

Factors	☐ Yes	☐ No	Comment
1. Transportation			
2. Movement of industry into/ or near community			
3. Movement of industry out of community/ or nearby community			
4. Change in zoning regulations			
5. Change in sub-division regulations			
6. Opening or closing of government or military installations			
8. Urban renewal			
9. Breaking up of large land holdings			
10. Increase in water, sewerage, etc. services			

General Comments: (Please use other side of sheet for this and for elaboration on any of the above questions.)

Appendix III:

CONCERNING SATURATION SAMPLING

The school census, discussed in Chapter 3, is a saturation census in which every possible respondent is questioned. Existing data in school and community records may be utilized to check the accuracy and completeness of a total census. Random samplings of families or age groups may be extracted from school attendance data. Similar samples may be pulled from the assessors' or building inspectors' records.

Frequently, the difficulties of obtaining a completely accurate picture on a saturation basis may be sufficient to cause the school system to consider a sampling procedure at the outset. If this is the case, it should be kept in mind that any sample should be based on the housing and not on the number of children even though the final goal is the prediction of school enrollment.

In a number of communities a ten percent sample of the housing units, single and multi-family, has formed an excellent basis for prediction. Care should be exerted to identify clearly the characteristics of the housing unit: its age, type (single, double, multi-dwelling), public or private, and any other data relevant to the movement of families.* Such a sampling procedure must be adhered to rigorously; for instance, every tenth listing in every apartment house as well as single house must be inventoried if the results are to be a basis for future estimates.

While checks on accuracy are desirable in any census, they are obviously not as necessary in a sample census where the basis is housing. However, a caution is in order. In certain localities, usually communities which are growing rapidly due to shifting from rural to suburban areas, the assessors' records may need to be checked against the building permits which have been issued to assure that all units are covered by the census.

*In one community in New Jersey the mobility of young families was such that the apartments always had more pre-school children than the total number of children the community had in school.

FOOTNOTES

1. Preliminary Statistics for State School Systems, United States Office of Education, Circular No. 663, 1959-1960.

2. Lawrence Derthick, past U. S. Commissioner of Education has testified that double sessions cause children to lose up to two months of schooling with a corresponding drop in achievement each year. The statement was made before the Subcommittee on General Education, Committee of Education and Labor, U. S. House of Representatives, 85th Congress, 1st Session, February 6, 1957.

3. American School Building, 27th Yearbook, American Association of School Administrators, Washington, D. C., 1949.

4. Thomas C. Holy, "What Futures Needs Are Revealed by School Population Studies?", The Education Digest, Volume 12, May 1947.

5. James D. MacConnel, Planning for School Buildings, Prentice-Hall, Englewood Cliffs, New Jersey, 1957.

6. "Predicting Population Changes in Small Areas," Studies in Business and Economics, University of Maryland, Volume 14, Number 4, March 1961.

7. Jacob S. Siegel, "Forecasting the Population of Small Areas," Land Economics, Volume 29, Number 1, February 1953.

8. Warren S. Thompson and P. K. Whelpton, Population Trends in the United States, McGraw Hill, New York, 1933.

9. John Hajnal, "The Prospect for Population Forecast," Journal of the American Statistical Association, Volume 50, Number 270, June 1955.

10. Helen R. White, "Accuracy of Selected Methods of Projecting State Populations," Journal of the American Statistical Association, Volume 49, Number 267, September 1954.

11. Leo M. Chamberlain and A. B. Crawford, "The Prediction of Population and School Enrollment in the School Survey," University of Kentucky Bulletin of School Services, Volume 4, Number 3, March 1932.

12. "The Effects of Large Lot Size on Residential Development," Technical Bulletin No. 32, Urban Land Institute, Washington, D. C., 1961.

13. "Forecasting School Enrollments," School Building Committee of the Metropolitan School Study Council, New York, New York, November 1953.

14. Map preparation and use has been thoroughly covered in a publication entitled "Local Planning Objectives and Basic Procedures" published by the Massachusetts Department of Commerce, Boston, Massachusetts, 1959.

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